

TITLE: "REINFORCED RESILIENT WIPER ELEMENT"

CROSS REFERENCES TO RELATED APPLICATIONS: NONE

**STATEMENTS AS TO RIGHTS TO INVENTIONS MADE UNDER FEDERALLY
SPONSORED RESEARCH AND DEVELOPMENT: NONE**

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to new and beneficial resilient wiping elements for interior wipers used in connection with tubular goods.

2. Description of the Related Art

Drilling rigs used for the drilling of oil and gas wells typically include a supportive rig floor positioned over a well, a derrick extending vertically above said rig floor, and a traveling block which can be raised and lowered within said derrick. During drilling operations, a drill bit and/or other downhole tools are generally conveyed into a well and manipulated within said well via tubular drill pipe. The drill pipe is raised and lowered within the well utilizing the drilling rig derrick.

When installing drill pipe or other tubular pipe into a well, such pipe is typically installed in a number of sections of roughly equal length called "joints". As such pipe penetrates farther and farther into a well, additional joints of pipe must be added to the ever lengthening "string" or "drill string" in the well. Thus, a typical drill string comprises

a plurality of threaded sections or joints of pipe, each of which has an internal, longitudinally extending bore.

During drilling operations, a fluid known as drilling mud is normally pumped down the longitudinally extending bore of the tubular drill pipe, and circulated up the annular space which is formed between the external surface of said drill pipe and the internal surface of the wellbore. In many cases, various additives can be added to said drilling mud to alter the characteristics, and improve the performance, of such drilling mud. For purposes of this disclosure, the term "drilling fluids" shall pertain to any number of different muds, fluids, additives and/or related materials pumped into a well.

The basic functions of drilling fluid are: (1) to cool and lubricate the drill bit and downhole equipment during drilling operations; (2) to transport pieces of drilled-up rock and other debris from the bottom of the hole to the surface; (3) to suspend such rock and debris during periods when circulation is stopped; (4) to provide hydrostatic pressure to control encountered subsurface pressures; and (5) to seal the porous rock in the well with an impermeable filter cake. In many cases, such drilling fluid can adhere or otherwise stick to the inner surface of tubular goods in a wellbore.

During the drilling process, it is frequently necessary to retrieve a drill string (i.e. drill pipe, workstring or other tubular goods used to conduct downhole operations) from a wellbore. In most cases, the drill string is pulled in sections. Frequently, the drill string is pulled one stand at a time, a stand being equal to three joints of pipe in ordinary circumstances. Moreover, after each stand is pulled from the wellbore, it is often "racked back." That is, the pipe is stored vertically within the drilling rig derrick

until such time as it is needed again, such as when the pipe is installed back into the well.

As a drill string is pulled from a wellbore, drilling fluids typically remain on the inner surface of tubular goods retrieved from the wellbore. Such drilling fluids often drip
5 from the unthreaded stands of pipe. Frequently, drilling fluids splash on the rig floor, thereby creating a safety problem. Specifically, the fluid spillage presents a danger to the personnel working on or about the rig floor.

Spillage of drilling fluid on the rig floor in the manner described above can also cause other problems. When a rig floor gets dirty, spilled drilling fluid can contaminate
10 the environment surrounding the drilling rig. Furthermore, excessive spillage of drilling fluids can be wasteful, since such drilling fluids are frequently very expensive.

For this reason, it is generally beneficial to reduce or eliminate spillage of drilling fluids during the drilling process. One way to reduce such spillage is to clean the interior surface of tubular goods while such tubular goods are being removed from a
15 wellbore. More specifically, the interior surface of tubular goods should be cleaned so that excess drilling fluid remaining in the inner surface of such tubular goods is directed back into the wellbore, rather than the rig floor.

Interior wiping devices have been known in the art for some time. Such interior wipers are devices that clean the interior surface of tubular goods, such as drill pipe,
20 workstrings and the like. Generally, such wiping devices comprise an elongate mandrel having at least one resilient wiper element extending radically outward from said elongate mandrel.

Such resilient wiper elements are typically formed of relatively thin stock and have the preferred form of sheet material cut in a circle and having a central bore. Generally, the elongate mandrel is concentrically received within the central bore of said resilient wiper elements. Further, said resilient wiper elements are notched at one
5 or two locations along the outer periphery to enable folding of said resilient wiper elements while passing through internal upsets or other restrictions in a pipe string.

In operation, a wiping tool is dropped into the inner bore of a drill string, typically while said drill string is being retrieved from a wellbore. Resilient wiper elements extend radially outward from the elongate mandrel to contact the interior surface of the pipe,
10 thereby pushing mud downwardly as the device falls within the pipe string. As the flexible wiping elements readily pass through the internal upsets in the pipe, a portion of said flexible wiping elements is bent upwardly.

Internal wiping devices of the type known in the art are typically dropped into a drill string while the pipe is being retrieved or "pulled" from a wellbore. Because of
15 buoyancy, such devices typically float in the column of drilling fluid in the pipe. As the pipe is pulled upwardly, the device travels relatively downwardly in the drill string. When passing through the pipe, the resilient wiping elements wipe drilling fluid on the internal surface of the pipe downwardly and keep the pipe relatively clean. In this motion, wiping is accomplished along the inner surface of the drill pipe, both where it is
20 full gage and also at the upsets and/or other restrictions where the pipe is reduced in diameter.

A major problem with such internal wiping devices is that the resilient wiper elements which actually come in contact with the internal surface of tubular goods

frequently tear. In many cases, such resilient wiper elements tear at or near the central bore of said wiper elements where they are installed on the elongate mandrel of the wiping devices. It can be extremely time consuming and expensive to continually replace such resilient wiper elements. Moreover, there is always the risk that torn wiper elements, or pieces thereof, can completely separate from the wiper device and fall downhole causing an obstruction in the wellbore.

So that the manner in which the above recited features, advantages and objects of the present invention are attained and can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to the embodiments thereof which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 side view of a prior art pipe wiping apparatus.

FIGURE 2 is a perspective view of a resilient wiper element used in connection with prior art pipe wiping apparatus depicted in FIGURE 1.

FIGURE 3 is a perspective view of a resilient wiper element of the present invention.

FIGURE 4 is a cross sectional view of resilient wiping element of FIGURE 3 along line 3-3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 of the drawings depicts a prior art wiping device 10. The device has a fishing neck 11 extending from fishing neck base 12 which enables grasping of the device with a fishing tool or other type of grappling tool. Elongate mandrel 13 extends from said base 12; and forms the central body of said wiping device 10. Washer 14 is concentrically received on elongate mandrel 13, and forms an upper barrier to clamp resilient wiper elements 20 on elongate mandrel 13. Spacers 15, 16, 17 and 18, which are also concentrically received on elongate mandrel 13, are spaced between resilient wiper elements 20. (Said resilient wiper elements 20 appear to be of different lengths in FIGURE 1; however, this is only because said resilient wiper elements are out of phase with one another). Resilient wiper elements 20 are formed of resilient sheet material, having protruding peripheral outer edges which can fold or bend during transition through the upsets on the interior of a pipe string. Resilient wiper elements 20 are formed with a central hole or bore which is sized to fit concentrically around elongate mandrel 13 thereby enabling proper axial alignment of all the components when assembled as shown in FIGURE 1. Plate 19 forms a lower barrier for said spacers and resilient wiper elements.

Spacers 15, 16, 17 and 18 have outer diameters that are approximately equal to that of washer 14 and plate 19, thereby allowing resilient wiper elements 20 to be clamped on the top and bottom faces thereof with substantially equal area components contacting against said resilient members. In this manner, resilient wiper elements 20 can flex, but remain secured.

FIGURE 2 depicts a perspective view of a prior art resilient wiper element 20 which can be used in connection with wiping tool 10. Said prior art resilient wiper element 20 is generally in the form of a circle, thereby defining curved peripheral wiping edges 21 and 22. Notches are cut into sides 23 and 24 of said resilient wiper element 20, resulting in areas of reduced material corresponding to said sides 23 and 24. Central bore 25 extends through said resilient wiper element 20.

In operation, wiping tool 10 is dropped in a drill string. Outer peripheral edges 21 and 22 of resilient wiper elements 20 extend radially outward from elongate mandrel 13 and physically contact the internal surface of said drill string. As wiping tool 10 falls within said drill string, drilling fluid is pushed in a downward direction as the device falls down into the pipe string. Said resilient wiper elements 20 are identical in construction to one another. However, in the preferred embodiment, said resilient wiper elements are positioned ninety (90) degrees out of phase from one another; this relative positioning enables said resilient wiper elements to extend outward and wipe the interior surface of the pipe so that any drilling fluid or other material on the inside wall is forced downwardly. Moreover, such ninety (90) degree rotation between adjacent resilient wiper elements assures that there are no notches which align so that the entire interior surface of the pipe is wiped.

During free fall, or when floating on a column of fluid in the pipe string, such resilient wiper elements continue to push the fluid downwardly even when the wipers pass through an internal upset in the drill string. When this occurs, a portion of the resilient wiper elements is bent upwardly; when folded in this fashion, such resilient

wiper elements continue to wipe with the nether face so that fluid is forced downwardly in the drill pipe.

It has been observed that a common reason why wiper elements, such as resilient wiper element 20, tear during use is because the spacers above and below such resilient wiper elements compress such resilient wiper elements. Such compression weakens the resilient wiper elements. Furthermore, said spacers frequently gouge or cut into said resilient wiper elements, which also causes said resilient wiper elements to weaken and become more susceptible to tearing. This is especially true when wiping tool 10 is jarred or otherwise disturbed, such as when the tool passes through an internal upset having a restricted internal diameter. Accordingly, it is desirable to reduce the compression effect caused by the spacers pinching or otherwise acting on resilient wiper elements.

FIGURE 3 depicts a perspective view of a reinforced resilient wiper element 30 of the present invention. Said reinforced resilient wiper element 30 can be used in connection with many different types of wiping tools, including prior art wiping tool 10. Said reinforced resilient wiper element 30 is constructed of flexible, yet resilient, sheet material. Although any number of materials can be used, in the preferred embodiment, said resilient wiper element is constructed of a high strength rubber or other suitable elastomer. Said resilient wiper element is substantially in the form of a circle, thereby defining curved peripheral wiping edges 31 and 32. Notches are cut into said resilient wiper element 30 along sides 33 and 34, resulting in areas of reduced material corresponding to said sides 33 and 34. Central bore 35 extends through said resilient wiper element 30.

Rigid area 36 surrounds bore 35. Although said rigid area can have any number of different configurations, in the preferred embodiment of the present invention said rigid area is in the shape of a ring around the outer circumference of bore 35. More specifically, said rigid area is a ring constructed of high strength material (such as, for example, a metal washer) molded within said resilient wiper element.

FIGURE 4 depicts a cross sectional view of resilient wiper element 30 of the present invention along line 3-3 of FIGURE 3. Central bore 35 extends through said resilient wiper element 30. Peripheral wiping edges 31 and 32 extend outward from central bore 35. Rigid area 36 surrounds said central bore 35, providing rigidity and structural reinforcement to said central bore. In the preferred embodiment, said rigid area is formed by washer 37 which is molded into said resilient wiper element.

Rigid area 36 provides strength against compressive forces exerted on the resilient wiper element by spacers, such as spacers 15, 16, 17 and 18 depicted on FIGURE 1. Specifically, said rigid area 36 prevents against flattening of said resilient wiper elements in the vicinity of central bore 35, thereby reducing or eliminating gouging or cutting of said resilient wiper elements by such spacers. As a result, resilient wiper elements 30 are much less likely to tear or break apart during normal use.

Although preferred embodiments of the subject invention have been described herein, it should be understood that various changes, adaptations and modifications may be made therein without departing from the spirit of the invention and the scope of the appended claims.